EXCERPTS:

"Localized air distribution and air filtration technologies (breathing-zone filtration systems) are now available for use in offices. In an open office space, a breathing-zone filtration (BZF) system should be capable of filtering air at a continuous rate of at least 100 cfm (50 L/s)."

"The present study was undertaken to test the effects of installing a furniture-integrated BZF system in an office. The BZF system tested consists of a fan and filtration unit. . . . The BZF system works by drawing aged office air past employees at worksurface height and into the filtration system; clean air is then supplied above head level at a user-adjustable rate. This BZF system works independently of the ventilation system, but it complements this by improving air mixing, which increases ventilation efficiency."

"Counts of the submicronic particulates (<0.25 um) were substantially reduced by the BZF system. . . . This reduction in particulates may account in part for the significant improvement in workers' perception of the general cleanliness of their workspace area, from 72% rating this as dusty in June to no one rating this as dusty in October."

"The impact of the BZF system on reported environmental conditions, employee satisfaction, productivity, and health was dramatic. Employee perceptions of indoor air quality conditions showed significant improvements with the BZF system. On the floor with the BZF system, complaints of poor indoor air quality fell by 72%, complaints of insufficient ventilation fell by 74%, complaints of too little air movement in the office fell by 65%, and complaints of stale and dusty air fell by more than 50%. Interestingly, complaints of electrostatic shocks also were reduced by almost 30%, this perhaps being a benefit of removing charged particulates from the air. . . . The BZF system reduced complaints about disruptions to productivity because of poor indoor air quality by almost 50%. The BZF system also decreased reports of work-related sick building syndrome symptoms by more than 50%."

"The present study was conducted in a building that did not have a history of indoor air quality problems, although the worker survey demonstrated widespread concern about these issues on both the control floor and the test floor. Installation of the BZF system on the test floor produced significant improvements in levels of airborne particulates and in occupant reports of indoor air quality, sick building syndrome symptoms, and productivity. These findings show that a BZF system can augment the perceived performance of the mechanical ventilation system."

"This study shows that the BZF system reduced symptoms of headache, lethargy, and dry skin and generally lowered the levels of other sick building syndrome symptoms. There was also a reduction in self-reported lost productivity among workers with the BZF system."

"The capital cost of the BZF system tested was relatively low -- about U.S. $170 per workers -- and, given the benefits that have been demonstrated, may be a cost-effective way of improving comfort ventilation. Each BZF unit uses about 85 watts of electricity at full output, so energy costs are low. The filtration units operate reliably and maintenance requirements are minimal. The VOC filter may require replacement after six months and the HEPA filter after two years, but filter replacement costs also are reasonable."

[4] **Hlady, W.G., Mullen, R.C., Mintz, C.S., Shelton, B.G., Hopkins, R.S., and Daikos, G.L., "Outbreak of Legionnaire's [sic] Disease Linked to a Decorative Fountain by Molecular Epidemiology,"** ***American Journal of Epidemiology*** **138(8): 555-562, 1993 [Issue 66, Item 27]**

While Legionnaires' Disease has been linked to aerosols spread by ventilation systems, this paper reports that an investigation of a disease outbreak in Florida suggested that spray from an indoor fountain apparently disseminated the bacteria.

EXCERPTS:

"Outbreaks of Legionnaires' disease have been linked to potable water systems, cooling towers, respiratory devices, showers, whirlpool spas, and ultrasonic humidifiers. This is the first report of an outbreak of Legionnaires' disease linked to a decorative water fountain."

"On January 27, 1992, a physician in Montana reported that he suspected Legionnaires' disease in one of his patients, with onset of the illness on January 14. The patient had attended a convention at a hotel in the Orlando, Florida, area on January 6-12 (convention A). The patient also stated that he had heard of several other individuals with similar illness among those who attended the convention. On the basis of this information, an epidemiologic investigation was begun."

"There were no differences between case patients and controls with regard to the area of the hotel in which they stayed, their activities outside the hotel, or their use of swimming pools, drinking fountains, showers, spas, or restaurants."

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"Only one of the water samples, from fountain 1, was positive for *L. pneumophila*, with a concentration of 400 colony-forming units per milliliter. . . . The water was occasionally treated with bromine, but there was no regular maintenance schedule, and no maintenance records were kept. The fountain appeared clean and free of any visible microbial growth or debris. . . . The fountain was surrounded by tables and chairs that were spattered with water from the spillways, but there was no obvious mist generation."

"This outbreak of Legionnaires' disease demonstrates the utility of new . . . techniques in identifying the likely source of infection in an outbreak situation where traditional epidemiologic methods proved inconclusive. Because of its location, nearly all hotel visitors were exposed at least briefly to fountain 1. All visitors who contracted Legionnaires' disease had lingered near the fountain, but because the number of case patients was small and many controls had also lingered in the fountain area, a statistically significant association with disease could not be demonstrated."

"Although the case-control study could not focus the investigation on a few suspected sources, a general environmental investigation proved fruitful when combined with clinical and epidemiologic information. Fountain 1 was the only potential source of infection identified. Negative microbiologic findings from other water sources in the hotel, combined with the facts that only two of the rooms of the case patients shared the same hot water system and that another of the case patients was only exposed to the hotel's convention hall and lobby areas, make another undetected source unlikely."

"Although this is the first report of Legionnaires' disease resulting from exposure to a contaminated fountain, an outbreak of Pontiac fever due to *L. anisa* was also linked to a decorative fountain, suggesting that decorative fountains colonized with *Legionella* may be public health hazard. The fountain associated with this outbreak of Legionnaires' disease was drained and cleaned, and intermittent chlorination is now used to maintain residual chlorine levels of at least two parts per million."

[5] **Hoskins, J.A., Brown, R.C., and Levy, L.S., "Current Levels of Air Contaminants in Indoor Air in Europe: A Review of Real Situations,"** ***Indoor Environment*** **2: 246-256, 1993 [Issue 66, Item 28]**

This "thorough review of the literature" summarizes data from a number of sources on indoor air quality measurements in Europe, for both smoking and non-smoking situations. Among their conclusions, the authors state that ETS contributes "rarely more than a fraction of the non-smoking level" of most indoor air constituents.

EXCERPTS:

"To bring together what is known on IAQ in Europe, we have undertaken a thorough review of the literature published since 1982. . . . We reviewed only the papers on IAQ which included actual measurements performed in real European environments. Work under experimental conditions, in situations that were not 'real-life', or tests in chambers were not included."

"Published work on the pollutants in indoor air is sparse, and many important pollutants have hardly been studied at all. As a consequence, the attention paid to individual pollutants is very variable and seems not to bear any relation to their perceived importance. Volatile organic compounds (VOCs) are the most studied, and, yet, with the exception of benzene, these compounds are not seen by many to be dangerous. Benzo[a]pyrene, on the other hand, has hardly been measured at all, though it is a known carcinogen. Every country in Western Europe, and several in Eastern Europe, has measured radon levels, probably due to the fact that its importance as a dangerous pollutant when present at low levels is under active debate."

"[T]here is a reasonable of body of data sufficient for the objectives of this review to be met in full. These objectives are, first, to bring together the monitored values for a number of pollutants from the published literature to see the basis for regulation, should this be worthwhile; second, to determine if smoking affects the burden of indoor air pollution appreciably, and, finally, to relate the pollution in real situations with existing workplace regulatory levels and other advisory guidelines."

"Studies of certain inorganic compounds produced by the combustion of organic matter have been abstracted from the literature on indoor air written over the last 10 years. The data in these studies has been divided into four basic types of environments: homes, public places, 'bars' and transport and further subdivided, where possible, into smoking and non-smoking. The reason for this is that many studies were carried out to show the effect of smoking on IAQ. Overall, total particulate levels in the air are not affected by smoking although the respirable fraction is. The oxides of carbon, nitrogen, using nitrogen dioxide as an example, and sulphur are nowhere present in amounts that would cause alarm were they in an occupational environment nor, on the evidence available, are they affected greatly by the presence of ETS, with the exceptions of nitrogen dioxide. Where there is an increase in pollutant levels in smoking environments, this is rarely

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more than a fraction of the non-smoking level, and either value is insignificant when compared to the TWA or STEL for the compound. It should be understood, however, that the occupational exposure limits used in industrial working environments for up to 8 h exposure, as a TWA, are set on specific criteria (health or economic base) and for a different purpose. Comparison for IAQ must therefore be made only with a great deal of caution."

"More validated measurements must be made to establish what the current norms are for all the compounds perceived to be important pollutants. Also, the measurements must be made to a plan, not, as so often in the past, as piecemeal measurements which are difficult to relate to other work. This considerable amount of work should be centrally coordinated by organisations such as the CEC or the WHO. . . . At present, it seems that the conclusions of the CEC document on IAQ which state that 'It is evident that much of the study of the indoor air quality and other factors affecting the indoor environment is in formative stages and that few definitive answers can be given to many of the problems encountered' perfectly states the situation for many pollutants. We hope that the review we have undertaken helps the process of identifying gaps and future needs."

[6] Lunau, F.W., "Air Quality Standards in Offices: Should They Be Health or Comfort Based?" *Indoor Environment* 2: 213-216, 1993 [Issue 64, Item 44]

The author of this commentary suggests that office workers and industrial workers could be equally well-protected by adherence to industrial exposure limits. However, he comments that office workers' perceptions of comfort may affect economic costs, and suggests that office IAQ questions be addressed by "guidance rather than regulation."

EXCERPTS:

"In very many countries, there exist legislation or other guidance governing the level of exposure to air contaminants to prevent untoward health effects in workers. These are different from general environmental air quality standards in that workers are recognised as reasonably fit adults, only exposed up to a predetermined retirement age, and their work pattern usually is such that they are generally exposed for 8 h in each 24-hour day for 5 days per week."

"Officer workers meet the above criteria, and therefore it seems reasonable to assume that by adherence to the above standards their health is adequately protected. Despite this, there is a considerable body of opinion that observance of the occupational exposure standards does not offer sufficient safeguard for the health of office workers."

"There are considerable practicable and indeed conceptual difficulties in the consideration of having different health-based exposure limits for office workers over those for other occupational groups when they all come from a common population."

"Whilst the subject is a very complex one, some elucidation can be gained by looking at the evidence cited in the determination of occupational exposure limits and contrasting it with the evidence cited in support of possible office exposure limits."

"The question of the populations concerned, i.e. industrial or office, is one not often directly addressed. . . . Nevertheless, in much of the literature, there are implicit or explicit statements that the populations are different. One such publication is ASHRAE Standard 62-1989. . . . [T]he office population is a selected one akin to the industrial population. It is very far removed from the general population which contains the very young, the very old and the very sick, all of whom require a different standard of air pollution control to safeguard their health."

"The question must now be posed as to whether, for essentially similar populations, there should be different legally enforceable air pollution standards."

"In the absence of a real health-based reason for office standards being lower than for industrial premises, what other reasons can there be for using a different exposure standard, either legally enforceable or in the form of guidance? One important reason is that of expectation and perception of the quality of the indoor environment, which equate to comfort. . . . In the office situation, dissatisfaction with the indoor environment (which includes many factors other than the chemical quality of the indoor air) will have its main effect as an economic one in terms of lower productivity, greater absence and greater staff turnover. . . . Whatever the figure, the solution to the problem is a management one and not one to be solved by legislative control."

"In conclusion, there is no logic in having different health-based legislative standards for industrial and office workers. The latter will have higher expectations and perceptions regarding their indoor environment. Failure to meet these expectations will not lead to clinically observable ill health, but will have an effect, possibly a

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large effect, on economic cost. Improved guidance rather than regulation is the best way to resolve office indoor air quality problems."

[7] **Monn, C., and Schaeppi, G., "Concentrations of Total Suspended Particulates, Fine Particles and Their Anionic Compounds in Ambient Air and Indoor Air,"** ***Environmental Technology*** **14: 869-875, 1993 [Issue 68, Item 33]**

The authors of this study conducted in Switzerland report that indoor levels of particulates generally correlated with outdoor levels, except in rooms with "heavy" smoking and gas stoves.

EXCERPTS:

"Suspended particulates are amongst the most important pollutants affecting respiratory health."

"This study has investigated the relationship between total suspended particulates (TSP, respirable particles) and fine particles (FP) with a cut-off at 4.25 um (alveolar fraction) and their anionic compounds (sulphate, nitrate) in ambient air during 1991-1992."

"[E]ight indoor environments (residences and offices) were chosen to measure indoor concentrations of FP and anions. Five homes and three offices in urban and rural areas were investigated during a three month period in spring 1992."

"In spring 1992, indoor/outdoor ratios were measured in five homes and three offices. Three measurements within three months were carried out at each location with respect to different activities."

"Indoor levels of FP showed a good correlation with outdoor levels, with the exception of rooms with heavy smoking and gas-stoves, where indoor concentration were higher than ambient levels. Levels of indoor NO_3 were very low. . . . Only in the presence of heavy smoking and a gas stove a concentration of 1.4 ug m^{-3} was observed. Indoor sulphate levels were in the range of the outdoor concentrations; the average indoor/outdoor ratio of 0.9 was in the range of other studies."

[8] **Norback, D., Bjornsson, E., Widstrom, J., Strom, G., Edling, C., Palmgren, U., Jansson, C., and Boman, G., "Asthma and the Home Environment." In:** ***Building Design, Technology, and Occupant Well-Being in Temperate Climates.*** **E. Sterling, C. Bieva, and C. Collett (eds.). Atlanta, ASHRAE, 329-333, 1993 [Issue 63, Item 33]**

The authors of this study report that, in a Swedish population, asthma symptoms were associated with the presence of house dust mites and with elevated carbon dioxide levels. They suggest that minimizing home dampness plus adequate ventilation are needed.

EXCERPTS:

"As part of a worldwide investigation of the prevalence of asthma and asthma symptoms, a case-control study was performed in the population of a community in central Sweden. The study comprised 44 subjects with asthma symptoms plus a random sample of 45 subjects without such symptoms. Room temperature, air humidity, volatile organic compounds (VOC), respirable dust, carbon dioxide (CO_2), airborne microorganisms, and mites in settled bedroom dust were measured in the dwellings."

"In a central Swedish urban population, house dust mites were significantly more common in the bedrooms of subjects with asthma symptoms than among controls (OR = 2.5 and 95% CI 1.1-6.1)."

"Furthermore, the average concentration of CO_2 was also higher in the homes of those reporting asthma symptoms, as compared to the controls (960 ppm and 850 ppm, respectively). For other exposure factors, such as air humidity, respirable dust, or relative air humidity, no significant differences could be demonstrated and the average room temperature (68.8°F) was the same in both cases and controls."

"The relation between asthma symptoms and CO_2 concentration was significant even when controlling for the presence of house dust mites . . . The measurement of volatile organic compounds (VOC) has not yet been evaluated."

"We could also show that normally only about 1% of indoor bacteria and molds in dwellings were viable. The prevalence of dwellings with microbial growth or building moisture was somewhat higher in cases as compared to controls (18% and 13%, respectively), but this difference was not statistically significant."

"In total, 14 of 89 homes (15%) had such signs of microbial growth or building moisture, as judged by an occupational hygienist. No significant differences between asthmatics and controls were found concerning the occurrence of such damp houses."

"House dust mites are frequently found in dwellings in central Sweden, and this can be explained by the fact that indoor air humidity is regularly above 40% even during the winter."

"Our results suggest that the average CO_2 concentration is above the comfort value of 1,000 ppm in many dwellings in Sweden. In addition, we could show that

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asthmatic symptoms are affected by inadequate outdoor air supply, even when controlling for the presence of house dust mites. Since asthma is a severe disease and is reported to be on the increase in many countries in the western world, three is a need to improve the general ventilation in the dwellings. In order to minimize the occurrence of house dust mites, indoor air humidity should be kept below 40% during the winter and building moisture should be avoided."

[9] **Rowe, D.M., Wilke, S.E., and Guan, L., "Examination of Sick Leave Absences from Work in Buildings with Various Rates of Ventilation,"** ***Indoor Environment*** **2: 276-284, 1993 [Issue 64, Item 45]**

Based upon data collected in seven Australian office buildings, none of which was "sick," the authors report that occupant sick leave absences were not related to the amount of ventilation provided. They suggest that other aspects of the indoor environment could be related to employee absenteeism, however.

EXCERPTS:

"The symptoms of sick building syndrome closely resemble those of several specific minor ailments. As a preliminary to testing for a relationship between them and the rate of supply of outdoor air for ventilation, Rowe established in 1987 a database containing details of sick leave absence from work of sample populations of workers in four office buildings in or near Sydney, New South Wales, for the year January to December 1986."

"[B]uilding 1a is naturally ventilated. . . . Buildings 2 and 4 are air-conditioned."

"[B]uilding 3 is also of good quality and is well maintained."

"[B]uilding 6 was added as an example similar to 3."

"Building 5 was included as an example with year-round re-circulation of return air and the minimum rate of ventilation by outdoor air then permitted."

"It has never been suggested that these are 'sick' buildings, but complaints have been registered regarding thermal discomfort due to direct solar gain and radiant heat from sunlit windows in buildings 2, 3, 4 and 5."

"Records of date, length of absence in quarter-day increments and the nature of approved sick leave for the sample populations were recorded in six broad categories with several sub-classifications, including allergy and headache."

"Ventilation rates were calculated from design drawings, as access was not available to the authors to measure actual flow rates."

"No significant correlation was found between rates of supply of outdoor air for ventilation and rates of sick leave absence due to minor respiratory and other illnesses of some 500 workers in this sample of 7 office buildings. The highest absence rates for the year 1986 were reported from the group located in the one naturally ventilated building 1a in the study with even higher rates reported from the same group of people in 1990/1991 after a move to near-new air-conditioned premises (building 1b). The increase may be due to this move into air-conditioned premises, but that the absence rates are much higher in both buildings than those reported by any of the other groups suggests, however, that they are not necessarily building-related at all."

"Rates of absence due to minor respiratory illness such as colds, influenza, upper respiratory tract infection and the like rose during winter months in all buildings. There does not, however, appear to be any notable relationship with ventilation rates."

"Although no correlation was found between the rates of supply of outdoor air for ventilation and sick leave absence rates, there were significant diffences [sic] between those experienced by undifferentiated sample populations in the buildings which persisted over the 2 sample years. It would therefore appear that building-related factors were responsible, at least in part, for these differences."

"It has been estimated that a reduction of the average annual rate of minor sick leave absence of the estimated 2.5 million office workers in Australia by half a day per person per year would result in improved productivity worth some $130 million. . . . It is suggested that investigation of aspects of the indoor environment in addition to ventilation by outdoor air are potentially fruitful and that such investigation should include simultaneously such factors as evaluation of the perceptions of the occupants, measurement of trace air contaminants, and detailed evaluation of installed service systems, finishes and furnishings."

"If further investigation confirms the absence of correlation between outdoor air ventilation rates and sick leave absence, it may be worthwhile to review current code requirements that have been revised upward in the recent past."

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[10] Rylander, R., "Experimental Exposures to (1-3)-Beta-D-Glucan." In: *Building Design, Technology, and Occupant Well-Being in Temperate Climates.* E. Sterling, C. Bieva, and C. Collett (eds.). Atlanta, ASHRAE, 338-340, 1993 [Issue 63, Item 34]

This paper reports on preliminary exposure studies using endotoxin and glucan, two substances produced by bacteria, which have been suggested as causes of symptoms associated with sick building syndrome. Although the sample size was small, and the reported results not statistically significant, the data suggest that the two substances may be related to the development of symptoms of irritation. The research was funded by the Center for Indoor Air Research (CIAR).

EXCERPTS:

"Previous studies have evaluated the relation between airborne glucan and endotoxins indoors and the extent of subjective symptoms."

"Even if a large number of studies were to show a relation between symptoms and these gents, proof concerning causality can only be obtained in challenge experiments where humans are exposed to the pure substance in concentrations similar to those found in the environment. This report describes the results from preliminary studies on effects after exposure to an aerosol of pure endotoxin and glucan."

"Aerosols of saline, endotoxin, and glucan in saline were produced . . . and introduced into the chamber through the ventilation air ducts about one hour before the subjects entered the chamber. The subjects were exposed during three [four-hour] sessions to saline, endotoxin, or glucan at five- to eight-day interval."

"There were no unexpected reactions or serious symptoms after the different exposures. The most marked reactions were found for nasal and throat irritation. At 1, 4, and 12 hours after exposure, an increase in throat irritation intensity was reported by three to five of the test persons with no difference between the endotoxin and glucan exposures. The intensity increases were statistically significant at 4 hours for nasal irritation . . . and at 12 hours for throat irritation."

"For symptoms of cough, there was an increase in intensity after endotoxin exposure at 4 and 12 hours but not after glucan exposure. Regarding headache, an increase in symptom intensity was reported only after glucan exposure -- three persons at hours 1 and 4 -- although this increase did not quite reach statistical significance. The intensity of redness of the skin increased at 4 hours after the glucan exposure. There was no increase in eye irritation after endotoxin or glucan exposures."

"In summary, the experience obtained in this first pilot experiment demonstrates that studies of this kind are feasible and that certain of the symptoms reported in sick buildings can be produced by exposure to endotoxin and glucan in amounts that are found in sick buildings. Further experiments are required to increase the size of the exposed group and to study different dose levels of the two compounds. In addition, it is desirable to perform objective tests to assess the exposure effect, such as measurements of pulmonary function or bronchial reactivity."

[11] Spicer, C.W., Kenny, D.V., Ward, G.F., and Billick, I.H., "Transformations, Lifetimes, and Sources of NO_2, HONO, and HNO_3 in Indoor Environments," *Journal of the Air and Waste Management Association* 43: 1479-1485, 1993 [Issue 63, Item 35]

This paper presents data on the measurement of the nitrogen oxides and their transformation products, nitrogen acids, in indoor environments. The authors report that nitrous acid (HONO) is formed by combustion (including tobacco) and by chemical reactions between NO_2 and indoor surfaces.

EXCERPTS:

"Recent research has demonstrated that nitrogen oxides are transformed to nitrogen acids in indoor environments, and that significant concentrations of nitrous acid are present in indoor air. The purpose of the study reported in this paper has been to investigate the sources, chemical transformations and lifetimes of nitrogen oxides and nitrogen acids under the conditions existing in buildings. An unoccupied single family residence was instrumented for monitoring of NO, NO_2, NO_y, HONO, HNO_3, CO, temperature, relative humidity, and air exchange rate. For some experiments, NO_2 and HONO were injected into the house to determine their removal rates and lifetimes. Other experiments investigated the emissions and transformations of nitrogen species from unvented natural gas appliances. We determined that HONO is formed by both direct emissions from combustion processes and reaction of NO_2 with surfaces present indoors. Equilibrium considerations influence the relative contributions of these two sources to the indoor burden of HONO. . . . The lifetimes with respect to reactive processes are on the order of hours for NO and HONO, about an hour for NO_2, and 30 minutes or less for

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HNO_3. The rapid removal of NO_2 and long lifetime of HONO suggest that HONO may represent a significant fraction of the oxidized nitrogen burden in indoor air."

"There are many possible sources of NO and NO_2 in indoor environments. These species are present in outdoor air, and may infiltrate buildings through normal air exchange processes. Indoor combustion is another source of these species, for example, the use of unvented natural gas, kerosene, or liquified petroleum gas (LPD) appliances, tobacco, and wood burning all contribute to indoor levels of NO and NO_2. Nitrous acid also has been reported in indoor air. Three possible sources of indoor HONO are:

1. Transport of outdoor HONO indoors by air infiltration.
2. Production of HONO by reaction of NO_2 with interior surfaces, with subsequent desorption of the HONO.
3. Direct emission from combustion processes."

"The research reported here demonstrates the importance of chemical reactions occurring in indoor environments for removing nitrogen dioxide from the air and producing gaseous nitrous acid. Our results show that nitrous acid is introduced into indoor air both by heterogeneous NO_2 reactions and by direct emissions from unvented combustion. We suggest that an equilibrium process influences the gas phase nitrous acid concentration, and that surfaces present indoors can serve as a reservoir for HONO."

"The rapid removal of NO_2 due to surface reactions, the formation of HONO by these reactions, and the relatively long lifetime for HONO, suggest that nitrous acid may represent an important fraction of the oxidized nitrogen burden in indoor environments. Because of this, and the recent reports that nitrous acid interferes with many of the methods used to measure NO_2 in indoor environments, it seems likely that some indoor NO_2 data collected in the past may have been influenced by the presence of nitrous acid."

[12] Strom, G., Norback, D., West, J., Wessen, B., and Palmgren, U., "Microbial Volatile Organic Compounds (MVOC): A Causative Agent to [sic] Sick Building Problems." In: *Building Design, Technology, and Occupant Well-Being in Temperate Climates.* E. Sterling, C. Bieva, and C. Collett (eds.). Atlanta, ASHRAE, 351-357, 1993 [Issue 66, Item 29]

These Swedish researchers suggest that volatile organic compounds produced by bacteria and fungi, which produce a characteristic odor, are often present in indoor air samples from "problem" buildings, where complaints of odor and eye, nose, and throat irritation were common.

EXCERPTS:

"To obtain a better understanding of the health effects of moldy buildings, other exposure indicators than signs of dampness or the concentration of airborne viable molds should be applied in epidemiological studies in the future. One such important exposure indicator is microbial volatile organic compounds (MVOC)."

"One aim of this investigation was to trace and quantify selective indoor volatile organic compounds originating from microbial growth (MVOC) within building materials of suspected damp houses. A second aim was to evaluate the relationship between total volatile organic compounds (TVOC) and MVOC in problem buildings. Finally, to elucidate the transport mechanism of MVOCs from the interior of building materials to the indoor air, the diffusion of MVOCs through two types of plastic films used as dampness barriers in Sweden was studied."

"The concentrations of 13 volatile organic compounds considered to be selectively produced by microfungi and bacteria (MVOC) that were measured in a house suffering from indoor environmental complaints and a reference house are presented. The problem building is an apartment where severe water damage had occurred. The family living in the apartment reported irritation in the upper respiratory tract. The major source for the odor problem is probably the occurrence of geosmin and 2-isopropyl-3-methoxy-pyrazine. These volatile compounds are normally produced by the . . . bacteria *Streptomyces* sp. Geosmin is also produced by some fungal strains."

"The problem buildings, including homes, office buildings, schools, and day-care centers, all suffered a little from problems of dampness or water damage. Complaints of odor problems and eye, nose, and throat irritation were common."

"In some of the problem buildings, microbial odor problems were reported at total MVOC concentrations of 12 to 15 ug/m^3, while in some houses no distinct odor was detected even at concentrations around 40 ug/m^3. This clearly demonstrates that the degree of the odor problem is not directly related to the sum of the MVOCs studied, but has more to do with the concentration of individual volatiles or combinations of volatiles. The major causative agents in odor problems need to be further investigated."

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[13] Walker, J.C., Jennings, R.A., Nelson, P.R., Morgan, W.T., Heavner, D.L., Robinson, J.H., deBethizy, J.D., and Stancill, M.W., "Sensory Responses to Environmental Tobacco Smoke from Tobacco-Burning and Tobacco-Heating Cigarettes," *Indoor Air* 3: 170-180, 1993 [Issue 65, Item 36]

Scientists from the R.J. Reynolds Tobacco Company report in this article on comparisons of a tobacco-heating cigarette with two tobacco-burning cigarettes and a nonsmoking control situation under experimental conditions where ETS levels were 10- to 20-fold higher than those measured in field samples. They report that ETS from the tobacco-heating cigarette was not evaluated as significantly different from the control situation by study subjects. Moreover, the authors report that eye blink rate did not differ among the various study exposures, although respiratory parameters seemed to change during exposure to ETS from the tobacco-burning cigarettes.

EXCERPTS:

"Sensory ratings, respiratory behavior and eye blink rate were recorded in 11 nonsmokers exposed to a no-smoking (CONTROL) condition or to environmental tobacco smoke (ETS) from one of three kinds of cigarettes: a Kentucky reference (1R4F), an ultra-low tar (ULT) and one that heats tobacco (TEST). For each two-hour session in a controlled-environment room, two smokers 'puffed' unlit cigarettes, for the CONTROL condition, or smoked 16 cigarettes to generate ETS (sidestream plus exhaled mainstream smoke). Concentrations of nicotine and respirable suspended particles (RSP) observed with the 1R4F and ULT cigarettes were 10- to 20-fold higher than those typically found in field sampling studies of office and restaurant smoking environments. The ULT and TEST cigarettes resulted in ETS analyte concentrations that were 77-100% and 0-56%, respectively, of those observed with 1R4F. Sensory ratings (odor, irritation, annoyance, acceptability) with the two tobacco-burning cigarettes were similar and were much greater than those recorded for the TEST or CONTROL conditions which were, in turn, rated similarly. Respiratory parameters (respiratory rate, total volume, expiratory time), which generally failed to discriminate the TEST and CONTROL conditions, were altered during exposure to ETS from the 1R4F and, to a lesser extent, the ULT cigarette. Eye blink rate was not significantly altered by ETS from any of the cigarettes."

"R.J. Reynolds Tobacco Company has developed a TEST cigarette that represents a significant advance in technology by heating tobacco to produce smoke without burning the tobacco."

"To date a study of perceptual and physiological responses of nonsmokers to ETS, that included thorough characterization of the room air, has not been reported. The key objective of the present study was to use such a comprehensive approach to determine whether the expected decline in the number and concentration of ETS constituents with the TEST cigarette resulted in a decrease in the sensory impact on nonsmokers. We characterized the composition of ETS from two tobacco-burning cigarettes and from the TEST cigarette and compared the physiological and psychophysical responses of nonsmokers to ETS generated from these cigarettes to those obtained when no smoking occurred. In order to increase the likelihood of obtaining sensory ratings with the TEST cigarette, which has greatly reduced SS, a heavy smoking schedule was employed for all cigarettes. Therefore, the concentrations of ETS constituents produced from the tobacco-burning cigarettes were much higher than those found in typical real-world environments where smoking occurs."

"With the tobacco-hearing TEST cigarette, concentrations of ETS analytes were either too low to be detected or were far less than with either of the two tobacco-burning cigarettes."

"ETS from the prototype tobacco-heating cigarette (TEST) had far less perceptual impact than ETS from two tobacco-burning cigarettes. Further, ETS from TEST was not evaluated as significantly different from room air in the no-smoking CONTROL condition. Respiratory parameters were generally consistent with the chemical and sensory measurements, although this kind of response appeared more variable and somewhat less sensitive as a measure of the response of nonsmokers to ETS."

"Eye blink rate was not significantly influenced by ETS from any of the cigarettes used in the study."

"The experimental approach employed in the present research, with its inclusion of perceptual and respiratory responses and its measurement of many chemical parameters of room air, should prove useful in future studies aimed at understanding the chemical and biological bases of the sensory properties of ETS."

[14] Willman, A.J., "Successful Indoor Ventilation Strategies," *Indoor Environment* 2: 221-222, 1993 [Issue 66, Item 30]

The author of this article reports on the National Energy Management Institute's IAQ program. He stresses

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the need to consider ventilation systems in addressing IAQ in buildings.

EXCERPTS:

"Indoor ventilation system modifications are the key to practical improvements in indoor air quality (IAQ)."

"Established in 1981, the National Energy Management Institute (NEMI) is a construction industry funded, non-profit organization."

"A key component of the IAQ program managed by the NEMI is directed specifically at the investigation of practical solutions to actual IAQ concerns."

"Recent U.S. political leaders have attempted to link any regulation to the costs borne by the business community. An analysis of the costs of ventilation system improvements conducted by the NEMI does not show any direct negative impact on the average business. Our data show that costs for ventilation system improvements can vary from no cost to more than US $100,000."

"While there is no documented link between enhanced worker productivity due to improved indoor air conditions, the business community would welcome even a small improvement in worker productivity. The cost of these improvements must be judged carefully in light of the long-term health benefit to the occupants. As noted by the U.S. Air Force in their May 1992 IAQ report produced at the Armstrong Laboratory, the 'cost of construction, operation and maintenance . . . is well worth the money'."

"Ventilation systems need to be the focus of attention when addressing practical commercial and institutional building IAQ problems. Using trained and qualified specialists is essential to ascertain the correct solutions. There is an increasing amount of state regulatory activity in the U.S. IAQ arena, and a new federal law is pending. Research is needed to ascertain the long-term medical implications of improved indoor ventilation solutions. At this point, the cost of ventilation system improvement can surely be seen to benefit the occupants."

STATISTICS AND RISK ASSESSMENT

[1] **Bero, L.A., Galbraith, A., and Rennie, D., "Sponsored Symposia on Environmental Tobacco Smoke,"** ***Journal of the American Medical Association*** **271(8): 612-617, 1994 [Issue 67, Item 35]**

Based on a review of symposium proceedings on ETS and articles on ETS published in the peer-reviewed literature, and a comparison of authors appearing in the symposia and in the 1986 Surgeon General's and National Research Council Reports on ETS, the authors conclude that symposium articles were more likely to support the position that purported health effects of ETS have not been conclusively established. Moreover, they suggest that tobacco industry funding and affiliations were more common among the symposium contributors. The authors suggest that an evaluation of the reliability of symposium articles should be undertaken by the court in the recently-filed suit against the EPA.

EXCERPTS:

"To suggest substantial support for their position that ETS is not harmful, the tobacco industry frequently cites industry-funded, non-peer-reviewed publications, such as symposium proceedings. This study examines symposia on ETS to determine whether they should be considered equivalent to other sources of scientific information on ETS. This study was designed to examine the extent of tobacco industry sponsorship of symposia on ETS; to see whether there was a balanced presentation of the data on ETS in such symposia compared with articles on ETS in the peer-reviewed literature; to test whether these symposia represented the work of tobacco industry-sponsored scientists relatively more than did articles on ETS in the peer-reviewed journals; and to compare the symposium authors and their sponsorship with the authors of two scientific consensus documents that concluded that ETS exposure is harmful to health. In short, this study gauges the number, sponsorship, authorship, and quality of symposia on ETS."

"We identified 11 symposia on the topic of ETS; four of these explicitly acknowledged tobacco industry funding. Although seven symposia did not acknowledge industry sponsorship, at least two of these were organized by individuals who are affiliated with the tobacco industry."

"Fifty-nine percent (175/297) of symposium articles presented original research and 41% (122/297) were review articles, compared with 90% (90/100) of journal articles that presented original research."

"[A] larger proportion of symposium articles than journal articles agreed with the tobacco industry's position."

"The distribution of topics of articles on ETS differed significantly between the symposium articles and the journal articles. The journals contained a larger proportion of articles that assessed the health effects of ETS, including epidemiologic studies and animal studies. The symposia contained a larger proportion of articles that

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assessed the effects of factors that could confound an association between ETS and tobacco-related diseases (eg, cooking smoke, radon, and diet)."

"[A] higher proportion of symposium authors than journal article authors were affiliated with the tobacco industry."

"[A] larger proportion of articles from symposia that acknowledge industry funding agreed with the tobacco industry position that ETS is not harmful than articles from symposia that did not acknowledge funding. Articles from symposia that did not acknowledge funding were more likely to focus on confounding factors than articles from industry-sponsored symposia."

"[T]he symposium authors published a lower proportion of peer-reviewed journal articles than the authors of the consensus documents. . . . While 85% (23/27) of the consensus document authors were affiliated with academic institutions, 36% (5/14) of the authors who frequently wrote symposium articles were from universities. In contrast, 43% (6/14) of the symposium authors were consultants to the tobacco industry and one worked for the tobacco industry, while none of the authors of the consensus reports were in similar positions."

"The content of symposia on ETS differs from the content of journal articles on ETS in ways that suggest that symposia are not balanced and that they present the tobacco industry position on ETS. Symposia consist, in large part, of review articles that reach conclusions that are contrary to independent scientific consensus documents and meta-analyses published in journals. Symposium articles minimized the potential effects of ETS on health by claiming that ETS exposure is impossible to measure, or if it can be measured, levels of exposure are not high enough to produce physiological effects. . . . Symposium articles contained a greater emphasis on potential confounding factors than journal articles. Most of the symposium articles, however, exclude ETS from comparative analysis of other health risk factors such as exposure to radon, cooking fuel, or automobile emission. For example, most articles discussing sick building syndrome did not mention ETS as a component of indoor air."

"The scientific reliability of the journal articles or consensus documents should be considered superior to that of symposia."

"Our data suggest that industry control over publication, rather than industry funding for research, is likely to influence the presentation of findings."

"The finding that data and reviews suggesting that ETS is not a health hazard are published in non-peer-reviewed literature has substantial implications for public policies regarding smoking restrictions. In June 1993, the US Supreme Court ruled that federal judges must ensure that scientific evidence and testimony admitted in trials are reliable. Whether the data have been subjected to peer review and publication is one criterion that judges are expected to consider. This ruling is directly relevant to the lawsuit that the tobacco industry has recently filed against the Environmental Protection Agency (EPA) claiming that the EPA used inaccurate and incomplete data for its risk assessment of ETS. As the court hears this case, it will have to decide whether non-peer-reviewed, tobacco industry-sponsored research, such as that presented in symposium proceedings, is admissible as evidence."

"Sponsored symposium proceedings influence public policy because they are often presented in a misleading fashion, as if they are equivalent to peer-reviewed journal articles, as if they are balanced reviews of the scientific literature, and as if they are not affiliated with the tobacco industry."

"The first tobacco industry-sponsored symposium occurred in 1974, well before journal articles on ETS were published. This suggests that the tobacco industry was concerned about adverse health effects of ETS before the medical community had conducted much research on the topic."

"Data from symposia should be reviewed skeptically since their funding sources may not be acknowledged, they have not been peer-reviewed, and they may not present a balanced overview of the scientific literature."

[2] **Huber, G.L., Brockie, R.E., and Mahajan, V.K., "Smoke and Mirrors: The EPA's Flawed Study of Environmental Tobacco Smoke and Lung Cancer,"** ***Cato Review of Business and Government: Regulation*** **1993(3): 44-54, 1993 [Issue 63, Item 36]**

The authors of this article summarize available data on ETS composition, exposure and lung cancer epidemiology, in support of their position that the EPA Risk Assessment on ETS was scientifically flawed.

EXCERPTS:

"Recently, the Environmental Protection Agency (EPA) completed a report concluding that exposure to environmental tobacco smoke (ETS) -- the residual material from burning cigarettes that is released into indoor air environments by the process of active smoking -- presents a serious and substantial public health problem. The EPA

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bases its conclusions not on any definitive set of data demonstrating causality, but on a generalized 'total weight of evidence' that, in aggregate, implied causality to the EPA. In reaching those conclusions, the EPA ignored classic criteria for cause-and-effect relationships employed by the scientific community."

"The purpose of this article is to address the more important parts of the EPA report that pertain to adults who are exposed to ETS."

"When the EPA 'speaks,' enormous weight is given to its findings. We generally presume that its conclusions are based on solid scientific evidence and are derived by standard scientific practices."

"Our presumption would be overgenerous in the case of the ETS report, unfortunately. In this case, the EPA's risk assessment is built on the manipulation of data, ignores critical chemical analyses and key epidemiological data, violates time-honored statistical principles, fails to control adequately for important confounding influences (factors other than the one studied that may affect a result or a conclusion) that provide alternative explanations for its conclusions, and violates its own guidelines for assessing and establishing risk to a potential environmental toxin. It lacks credible quality control and adequate external unbiased peer review. In short, in its report on ETS, the EPA did not comply with accepted principles of toxicology, chemistry, and epidemiology, nor with its own guidelines for undertaking cancer risk assessment. In fact, the conclusions drawn by the EPA are not even supported by the EPA's own statements."

"In critically questioning these matters, however, we are not saying that exposure to ETS is without hazard. The data that have been presented in the literature, though, simply do not support any definitive conclusions. We believe that reasonable scientists could interpret the published literature on ETS with differing opinions."

"The EPA states quite authoritatively that 'ETS is a complex mix of over 4,000 compounds.' The EPA states equally clearly that 'this mix contains many known or suspected carcinogens or toxic agents.' Both statements are dubious. No scientific literature supports the assumption that ETS should be treated as a functional equivalent to mainstream smoke."

"What nonsmokers might inhale passively in the presence of smokers is not quantitatively or qualitatively the same material that active smokers inhale from the butt end of a cigarette."

"Is the EPA meta-analysis a scientifically valid manipulation of data? Combining data and undertaking a meta-analysis are valid procedures under appropriate circumstances. But in order to make the outcome value of their meta-analysis 'valid' and 'statistically significant,' the EPA first had to adjust the data as originally published in peer-reviewed literature and, second, they had to broaden the confidence intervals to a scientifically unconventional level of 90 percent."

"When a number of studies are combined, the confidence intervals generally are 'ratcheted down,' or tightened, to assess significance; the EPA did just the opposite and in so doing diminished its report's scientific value. Lowering of statistical standards to make valid otherwise unmeaningful results is an unusual and dubious scientific practice. . . . The manipulation of data in this manner to develop statistical significance permitted the EPA to declare passive smoking a Group A carcinogen -- the highest rank possible. Without the recalculations and manipulations, the EPA would have not met any of the three classic criteria for establishing risk."

"The EPA's risk assessment acknowledged that confounders are important to any evaluation of ETS as a potential carcinogen. Its concern for confounders was extremely limited, however, and their influence was evaluated by employing a modeling of data by a method as yet untested and unproved by conventional peer review. The EPA, in essence, ignored its own guidelines and established requirements to rule out confounding as an alternative explanation for an association before basing causal inference on epidemiologic results."

"Scientific integrity was compromised, if not outright abused, by the manner in which this risk assessment was generated. . . . Science should dictate what policies need to be established; predetermined policies should not dictate how science should be interpreted. . . . Will reality and fact ever catch up with political science at the EPA?"

[3] Luik, J.C., "Pandora's Box: The Dangers of Politically Corrupted Science for Democratic Public Policy," *Bostonia*, pp. 50-59, Winter '93-'94 [Issue 66, Item 31]

John C. Luik, identified as a nonsmoking Senior Associate of the Niagara Institute, proposes in this article that the EPA's treatment of ETS is an example of corrupt science. He suggests that the EPA manipulated data to achieve its conclusions, misrepresented the process it used, and failed to consider dissenting opinions.

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EXCERPTS:

"In order to understand the ways in which science and public policy intersect in the debate over smoking -- as indeed over many other 'health' issues -- it is necessary to place the smoking controversy in general and the Environmental Tobacco Smoke controversy in particular within the larger context of both governmental and nongovernmental efforts to discourage tobacco use."

"For example, once it was established that smoking increased the risks of ill health in smokers, the groundwork was laid for a series of moral arguments that purported to show that subjecting oneself to these risks was both so irrational and immoral as to justify government efforts to prevent one from assuming the risks."

"Health paternalism is thus a subtle shift away from the generally uncontroversial right of the State to ensure that consumers are fully informed about the risks of certain products or activities to their health to the highly contentious claim that the State is justified in attempting to manipulate and coerce."

"It is only by demonstrating that the dangers from smoking transcend the smoker and extend to innocent bystanders that the anti-smoking movement could move beyond obvious health paternalism and enlist unambiguous support for public-policy measures designed to restrict, ban, and criminalize public smoking. . . . What is new is the consideration of science and morality to justify public policy."

"We wish to argue that:

1. the 'science' supporting the claims about tobacco's risks to non-smokers is corrupted science, science that has been politically laundered, science that because of its corrupted status actually ceases to be science;
2. the use of such science by the government and the anti-smoking movement reveals not only the illegitimacy of their public-policy agenda but the flawed character of the advocacy as well; and
3. the existence and use of such corrupted science poses a significant threat to legitimate democratic public policy."

"If the government and the anti-smoking lobby are to justify their claim that the debate in society about smoking in the last decade of the twentieth century is really a debate about the dangers that smoking poses to nonsmokers then it is imperative that those dangers be demonstrable, compelling, unequivocal, and significant. And it is only science that can deliver dangers with the requisite pedigree. . . . Everything, therefore, depends on science. And with so much at stake, the pressure to adjust, shave, create, ignore, reevaluate even manipulate, is enormous."

"But what, it might be asked, is corrupted science? And more importantly, what is the evidence that the official Environmental Tobacco Smoke story is indeed an instance of such a corrupted science? Could it not be the story is indeed an instance of such science? Could it not be the case, for instance, that the Environmental Protection Agency's conclusions about ETS are in fact simply incompetent science, science that has failed to do its work properly but not science that has deliberately decided to tell the wrong story?"

"Corrupted science has at least three characteristics that mark it off from simply incompetent science."

"First, corrupt science is science that moves not from hypothesis and data to conclusion but from mandated or acceptable conclusion back to selected data in order to reach the mandated or acceptable conclusion."

"Second, corrupt science is science that misrepresents not just reality, but its own process in arriving at its conclusions."

"Third, and perhaps most important, whereas normal science deals with dissent on the basis of the quality of its evidence and argument . . . corrupt science seeks to create formidable institutional barriers to dissent through excluding dissenters from the process of review and contriving to silence dissent not by challenging its quality but by questioning its character and motivation."

"[T]he EPA *did not examine those studies that look at workplace ETS exposure.* The overwhelming majority of these do not find a statistically significant association between exposure to ETS and lung cancer in nonsmokers: a fact that by itself destroys the legitimacy of any harm-based demand for public or workplace smoking bans."

"So in assessing the global scientific evidence about ETS and lung cancer, the crucial conclusion is that *none of the studies report a strong relative risk for nonsmokers married to smokers.*"

"Using the accepted 95 percent confidence level *none* of the eleven studies reported a statistically significant risk."

"It is this finding of statistical significance, a finding based on only eleven U.S. studies, *none* of which demonstrate a statistically significant increased risk unless they

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are 'reanalyzed' using the EPA's 90 percent confidence interval (and even such 'coaxing' of the figures could produce only one study that purported to show statistically significant increased risk), that provides the *only* basis for the EPA's decision to classify ETS as a 'Group A' carcinogen."

"[T]he EPA conclusion is based on a meta-analysis that is difficult, if not impossible, to verify."

"By using a one-tailed test the EPA assumes that ETS exposure can only increase the lung cancer risk, despite the fact that *a substantial number of studies show a decreased risk*. . . . While the EPA claims that a one-tailed analysis actually compensates for a 90 percent confidence interval, what the use of such an analysis actually does is reduce the confidence level even further."

"Curiously, the EPA decided that in this instance it would use a 90 percent confidence interval, something that effectively doubles the chance of being wrong. Even more curious is the fact that when asked to justify this departure from accepted scientific procedure, EPA administrator Reilly simply replied that the 90 percent confidence interval 'was recommended to us by the scientific community as appropriate to this data.' What Mr. Reilly really means by 'appropriate to this data' is that *without using this 90 percent standard, the EPA could not have found that the eleven U.S. studies were 'statistically significant.'* Without employing a novel standard, without in effect changing the accepted rules of epidemiological reporting, the EPA result, already painfully coaxed into existence, would not have existed, and ETS could not have been labeled a 'Group A' carcinogen."

"[A]n examination of the process underlying this science demonstrates even more clearly its wholly corrupted character."

"First, EPA science issues from a perspective that can be traced back to the Lalonde Doctrine propounded by former Canadian Minister of National Health and Welfare, Marc Lalonde. Lalonde argued that health messages must be vigorously promoted even if the scientific evidence was incomplete, ambiguous, and divided."

"But second, while those involved in the EPA process are at one level open about the process, at another level they are profoundly dissembling."

"Third, the ETS risk assessment process has been corrupted from the outset by the fact that it has repeatedly violated the standards of objectivity that prevail in legitimate science by utilizing individuals with anti-smoking biases."

"Fourth, the EPA changed the accepted scientific standard with respect to confidence intervals, without offering any compelling justification, in order to make its substantive findings statistically significant."

"Fifth, the EPA's Workplace Policy Guide which as a policy document would, in the course of normal scientific process, be developed only after the scientific evidence was in, was actually written before the scientific risk assessment was even completed, let alone reviewed and finalized. Quite obviously, science was to be made to fit with policy, rather than policy with science."

"Sixth, the EPA fails to note that, if the two most recent U.S. ETS studies were to be included along with its eleven other studies, it would have resulted in a risk assessment that was not statistically significant, even using the 90 percent confidence interval. With its entire 'conclusion' at risk, there are exceedingly compelling process reasons for the EPA to have excluded these two later studies from their analysis."

"Seventh, exclusion, however, was apparently insufficient, for the EPA does more than simply not use the studies, it actually refers to them in an appendix and misrepresents one of them by claiming that it supports the EPA's ETS conclusions. . . . In effect, the EPA misrepresents a scientific finding by changing the terms of reference from statistical significance to just plain risk."

"Eighth, the EPA represents its process as a comprehensive and objective analysis of the ETS data. In the usual course of things this would imply a careful examination of the criticisms that have been leveled at the studies used to reach its conclusions. However, a careful examination of the bibliography accompanying the report suggests that this is not the case."

"Ninth, there is significant evidence that the EPA ignored the misgivings of its own scientists about its ETS assessment process and conclusion. Two internal EPA documents (April 27, 1990, and March 23, 1992), both by the EPA's Environmental Criteria and Assessment Office and both recently released by Congressman Tim Valentine, suggest that the EPA process and report was badly conceived and argued, that the alleged 'causal' connection between lung cancer and ETS was overstated, and that the evidence does not support a Group A carcinogen classification for ETS."

"Tenth, despite the significant difficulties that have been raised about the quality of EPA science, the EPA process is incapable of correcting itself. this was made particularly clear by the Expert Panel in its report *Safeguarding the Future: Credible Science, Credible Decisions.*"

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"This is perhaps the most significant process corruption of all, namely a process that is quite conscious of its problems but is unwilling and unable to address them."

"One moral question is obviously the question of the legitimacy of misrepresentation, for corrupted science is at bottom science that misrepresents the state of reality. And what a careful analysis of the scientific claims of the EPA and the anti-smoking movement reveal is a profound and systematic disregard for the truth about the dangers from ETS."

"But is a smoke-free society a sufficient justification for a public health movement founded on unreliable science and blatant misrepresentation? We would suggest that it isn't."

"But there is a second moral question here that goes beyond the morality of misrepresentation into what might be called the morality of suppressing dissent. . . . Whatever the cost, 'science' must be seen to provide a conclusive and united answer to the question of tobacco and its harms to the innocent. Thus, despite the vital role of questions, argument, and dissent in science as well as in democratic life, the anti-smoking movement seeks to silence dissent in the interests of protecting not the truth but its misrepresentation of the truth."

"The third moral question centers on what the manufacture and use of such science does both to science and to legitimate democratic public policy."

"If science ceases to work outside of the political and policy process, if it ceases to be a tool available to all sides of an issue, if it becomes politicized and ideologically sensitive, then it ceases to be valuable in the policy process. Rather than acting on the voice of reason, it becomes nothing more than another special pleading."

"But the use of bogus ETS science to manipulate the public-policy debate on smoking threatens not just science, but also the standards of rationality that distinguish legitimate public policy."

"The use of corrupted ETS science is, however, more than simply an abandonment of reason in the public policy process; it is also frightening, an attempt to institutionalize a particular irrational view of the world as the only legitimate perspective: to replace nationality with dogma as the legitimate basis of public policy."

"By far the most morally objectionable aspect of the anti-smoking movement's use of the ETS issue is its readiness to use corrupted science to deprive smokers not only of their right to pursue their pleasure in public, but quite possibly to gain or retain their employment, or advance their prospects."

"The debate about Environmental Tobacco Smoke, though ostensibly a debate about smoking, is really a debate about much more than smoking. It is a debate at bottom about the legitimacy of perverting science and public policy founded on science in the interests of a particular health ideology. It is a debate at bottom about the worth of a health paternalism that guarantees to leave all of us substantially less free but no less ill."

[4] Skrabanek, P., "The Epidemiology of Errors," *The Lancet* 342: 1502, 1993 [Issue 66, Item 32]

In a critique of "risk-factor epidemiology," Skrabanek comments on the tendency of associations to be reported as causal relationships. Without naming the EPA, he lists characteristics of the EPA Risk Assessment on ETS, and describes the treatment of ETS as "corrupt science" used to reach a "mandated conclusion."

EXCERPTS:

"'A good deal of scientists, many of them in the professional fields of epidemiology and public health, have never learned how to avoid waffling when yes or no are not available and the only correct answer is, I don't know'. Lewis Thomas was referring to risk-factor epidemiology. By the misuse of language and logic, observed associations are presented as causal links. Electric blankets are said to increase the risk of breast cancer; coffee drinking in men reduces their risk of developing breast cancer; and so on."

"[R]isk-factor epidemiology relies on case-control or cohort studies, without rigorous standards of design, execution, and interpretation, even though such studies are susceptible to at least fifty-six different biases. Observed relative risk (or odds ratios) in such studies are generally so small that even if their confidence intervals do not include unity, they are well within the limits of errors caused by unavoidable biases and confounding, which cannot be rectified by statistical manipulation."

"Statistics are no cure for the faulty paradigm of risk-factor epidemiology. . . . Phillips and Davey Smith suggest that a major revision of how observational epidemiological studies are designed is now in order: instead of larger samples, more measurements of risk factors would readily compensate for a reduced sample size. But would concern about measurement imprecision solve anything? As the Irish country saying goes, you cannot make a pig grow by weighing him. . . . The purpose of risk-factor epidemiology is to provide testable hypotheses and not to narrow confidence intervals of spurious associations."

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"In politically sensitive areas -- for example, the alleged harm of passive smoking -- poor data are manipulated to reach a foregone conclusion, even if it means arbitrary adjustments, selective meta-analysis, 90% confidence intervals, and one-tailed statistics, to save a relative risk of 1.19 from being insignificant. This may be a special cause when corrupt science moves from mandated conclusion back to selected data in order to reach the mandated conclusion. But there is also a general malaise in risk factor epidemiology, the symptoms of which fit the description of pathological science."

"Risk-factor epidemiology will need more than better or more frequent measurements to establish itself as a science."

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